

THE  
PSYCHOLOGICAL BULLETIN

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PROCEEDINGS OF THE TWENTY-FIRST ANNUAL  
MEETING OF THE AMERICAN PSYCHOLOGICAL  
ASSOCIATION, CLEVELAND, OHIO, DECEMBER 30  
AND 31, 1912, AND JANUARY 1, 1913

REPORT OF THE SECRETARY, PROFESSOR W. V. BINGHAM,  
DARTMOUTH COLLEGE

The twenty-first annual meeting of the American Psychological Association was held at the Western Reserve University, Cleveland, on Monday, Tuesday and Wednesday, December 30 and 31, 1912, and January 1, 1913, in affiliation with the American Association for the Advancement of Science.

The attendance at the meetings was excellent. It included, naturally, more than the usual number of members from the central West.

The sessions, with one exception, were held in the Physics building of Adelbert College. In spite of the fact that this location was several miles from the hotel headquarters, it proved to be very satisfactory. Local plans had been made with unusual foresight, and everything was done that could be done by the hosts of the Association to add to the convenience of the arrangements, and the comfort of the members.

On New Year's Eve, a psychologists' dinner was shared by seventy of the members and their friends. Following the dinner, the Association listened to the address of the President, Professor Edward L. Thorndike, on "Ideo-motor Action." The speaker vigorously attacked the widely current doctrine. He reported the results of a study of American psychologists which showed that although a majority of them hold to the doctrine that an idea of a movement tends to produce the movement it resembles, nevertheless these same psychologists believe that the less the idea resembles a desired

movement, the more efficient it will be in producing it! The doctrine of ideo-motor action was declared to be a lineal descendant of the belief of primitive man in magic, a vestigial survival in scientific thought of an ancient superstition. The animated discussion which this address provoked at the smoker which followed later in the evening, served to dispel any apprehension that American psychologists have lost interest in analytical and theoretical questions, and today care only for the problems of experimental and applied psychology.

It is true that more than three fourths of the forty-one papers read at the meetings were reports of experimental investigations. Of this number eight were in comparative psychology, fifteen in applied psychology, and ten in experimental psychology. In addition there were six papers upon various topics in general and analytical psychology and psychopathology, and three papers upon themes of common interest to psychologists and anthropologists, read at the joint meeting with the American Anthropological Association and Section H. At this session, which was the most largely attended of any, an address was given by Professor Felix Krueger, of Halle, Kaiser Wilhelm Exchange Professor of Psychology at Columbia University; and Professor George Trumbull Ladd delivered the address of the retiring Vice-president of Section H.

The display of new apparatus included a keyboard problem box for studying types of learning in human subjects, and two voice recorders, by Professor Shepard; a simple and convenient graduated brake for electric motor, by Dr. Frost; and new forms of chronoscopes by Dr. Dunlap and Dr. E. E. Jones. Still another new form of measuring association reaction was demonstrated at the Tuesday afternoon meeting by Dr. Brown, of the Physical Laboratory of the University of Iowa.<sup>1</sup> At the Friday afternoon session, a representative of Bausch and Lomb demonstrated a new stereopticon attachment for the projection of monochromatic light, complementary colors, and color mixtures. The display of standard apparatus by the Stoelting Co. was again a prominent feature of the exhibit.

Professor Kirkpatrick had on exhibition a sample of the series of photographs of psychologists which he has prepared. The interest shown in the project was sufficiently keen to warrant him in going forward with the plans.

Ten of the members who had expected to read papers were un-

<sup>1</sup> Brown, F. C., "An Electrical Method of Measuring Small Intervals of Time," *Physical Review*, 34, 452-458.

avoidably detained; but even so, there was no lack of program material. Rather, the program, in spite of arrangements for two simultaneous sessions, proved to be quite compact. An inordinately large number of contributors failed to compress their reports into the time limits they had requested, with the result that all too little time was available for informal discussion. The large audiences, too, tended somewhat to check spontaneous debate. It is evident that the Association will be compelled in the future to choose between some of these alternatives: lengthening the period of meeting to four or five days; cutting down the maximum time limit assigned to papers and holding readers strictly to the period specified; refusing a place on the program to a fraction of the members with reports to present; accepting only those titles which bear on certain specified groups of topics; increasing the number of simultaneous sessions and group meetings; *or*, making no allowance of time whatever for informal discussion.

This last alternative would, without doubt, be most unsatisfactory. The plan of parallel sessions has many advantages and some disadvantages. There will inevitably be those at each meeting who will protest because papers in which they are interested are being read in different meetings at the same time. On the other hand, the audiences will be smaller and more homogeneous, and this will conduce to greater freedom of comment and criticism.

In this connection it may be announced that the newly elected executive committee proposes, in making plans for the next meeting, to use every means in its power to encourage members to prepare their reports in such a manner that they may be presented to the Association without transgressing the usual limits of time. This will involve in many instances the abandonment of any efforts to present orally either elaborate accounts of methods used or detailed statements of results,—details which can in any case be much more easily grasped when they appear in printed form.

Another plan which may be adopted in the effort to encourage free discussion and interchange of ideas is that of holding round tables. Relatively small groups, made up, for example, of psychologists actively engaged in perfecting tests of mental development, or of psychological workers in reformatory institutions, or of investigators of the "imageless thought" problem, may meet to confer at length regarding questions peculiar to their work.

Authors' abstracts of the papers read will be found following the report of the business meeting. In conformity with a vote of the

council at the Washington meeting, no papers were listed to be read by title.

#### TRANSACTIONS AT THE ANNUAL BUSINESS MEETING

A brief preliminary business meeting was held on Tuesday at a time when the attendance was at a maximum, to hear the report of the special committee on methods of nomination and election of officers. This report, presented by Professor Aikins, had been formulated in the light of a wide inquiry into the methods of election used by the many learned societies of America. The committee recommended:

I. That those portions of the constitution dealing with the election of officers be suspended for three years.

II. That during that period the President and two members of the Council be nominated by a nominating committee elected at the annual meeting one year before that at which they are expected to report.

III. That this nominating committee consist of three members elected by ballot (without previous nomination) at the annual meeting, the persons receiving the largest number of votes to be declared elected to this nominating committee, the President casting the deciding vote or votes in case of a tie.

IV. That it shall be the duty of the nominating committee to communicate with every member of the Association, asking for nominations or suggestions, before making its nominations to the Association. The nominating committee shall also file with the Secretary a memorandum as to the number of members who send in replies, and other similar data, for the future guidance of the Association.

V. That the Secretary of the Association be nominated by the Council as at present.

VI. That at the end of three years a new committee shall be appointed to consider and report upon the working of the above plan.

The recommendations of the committee were adopted and Professor Angell, Professor Watson and Professor Thorndike were elected to act as a nominating committee for the coming year.

At the regular business meeting, the following officers, nominated by the Council, were elected: *President*: Professor Howard C. Warren, of Princeton. Members of the Council to serve three years (Professors Lindley and Yerkes retiring): Professor J. W. Baird, of Clark University, and Professor Madison Bentley, of the University of



Illinois. Member of the Council to serve one year, filling the vacancy caused by the election of Professor Warren as President: Dr. Shepherd Ivory Franz, of Washington, D. C. Representative on the Council of the A. A. A. S.: Professor Robert M. Ogden, of the University of Tennessee.

On recommendation by the Council, the following persons were elected to membership in the Association: Henry Foster Adams, Ph.D., University of Michigan; Charles Macfie Campbell, M.A., Bloomingdale Hospital, White Plains, New York; Walter Bradford Cannon, Ph.D., Harvard Medical School; Wallace Craig, Ph.D., University of Maine; Ludwig Reinhold Geissler, Ph.D., University of Georgia; William Healy, A.B., M.D., Juvenile Psychopathic Institute of Chicago; Thomas Verner Moore, Ph.D., Catholic University, Washington, D. C.; Jared Sparks Moore, Ph.D., Western Reserve University; Rudolf Pintner, M.A., Ph.D., Toledo University; Albert T. Poffenberger, Jr., Ph.D., Columbia University; B. R. Simpson, Ph.D., Brooklyn Training School for Teachers; Clara Harrison Town, Ph.D., Lincoln State School and Colony, Lincoln, Illinois.

The report of the treasurer was read, as printed below, and accepted.

The Council reported the following statement of policy, formulated after considering the urgent wishes of members who prefer sometimes to meet apart from the large group of societies affiliated with the A. A. A. S.: It is the opinion of the Council that in determining the place of the annual meeting, consideration should be given to the desirability of meeting in alternate years apart from other organizations, or in affiliation with some other small association with kindred interests.

Invitations had been received to meet next year at Yale University, Johns Hopkins University, and also at Atlanta, where the A. A. A. S. and the Southern Society for Philosophy and Psychology are to meet. An invitation had also come from the executive committee of the American Philosophical Association, suggesting a joint meeting. It was voted to hold the next meeting at New Haven, subject to later action by the Council.<sup>1</sup>

Professor Martin brought to the Association an invitation to hold a meeting in California in the summer of 1915. She also outlined a fascinating project for an excursion of psychologists to San Francisco by way of Panama.

<sup>1</sup> The place of meeting of the American Philosophical Association has not been fixed, but it is hoped that it, too, will arrange to meet in New Haven.

Professor Warren presented the following report of the committee on the relations of the Association to American periodicals concerned with psychological research: "During the past year we have discussed several projects for coöperation among the periodicals for the benefit of their contributors and readers. Besides the question of a psychological *Centralblatt*, which was before us last year, we have considered propositions for coöperation in subscriptions, for the better support of scientific publications by scientists, for the regulation of exchanges, and for systematic information of contributors as to requirements and etiquette in offering contributions. We cheerfully recognize the obligations of scientific periodicals to their contributors and readers as represented in this Association. Nevertheless each topic brought forward has revealed considerable divergence of standpoint and interest among the periodicals represented on the committee.

"After two years of friendly discussion we have reached the conclusion that no useful end would be served by continuing this Committee. The present committee has been successful in bringing the magazines together and promoting good feeling among them as never before. We believe that any further coöperation would best be accomplished in a more informal manner, on the initiative of the editors themselves. We therefore ask that this committee be discharged."

The report was accepted and the committee discharged.

The report of the committee on the relations of psychology and medical education outlined the scope of an inquiry it has under way. The Association voted to accept the report, to continue the committee, to continue the appropriation set aside last year for its expenses, and to authorize the publication of the finished report of the committee immediately upon the conclusion of the investigation. The expenditure of \$20 to cover the cost of publication was authorized.

The following expenditures were also authorized: A sum not to exceed \$25 for expenses incurred by the special committee on methods of nomination, in gathering data for their report; a like sum to cover expenses of the nominating committee for the current year; and a like sum to cover express charges and other expenses which may be incurred in arranging an apparatus exhibit at the next annual meeting.

At the annual meeting in 1911 the following resolution had been introduced by Professor Cattell and, on his motion, referred to the Council for consideration and report: "*Resolved*, that the American Psychological Association regards it as inadvisable for any of its members to accept a position in a summer school in which the rate

of payment per week is less than he receives during the academic year, or to take an extension or similar course for which the payment *pro rata* is less than for his regular work."

Upon recommendation of the Council, the Association, after full discussion, voted unanimously to adopt this resolution, and to instruct the secretary to transmit copies to the directors of summer schools.

The Association also adopted the following resolutions, upon recommendation of the Council: "*Resolved*, that the American Psychological Association lends its support in any efforts which the A. A. A. S. may make to secure action by the United States Government permitting duty-free importation of scientific books in English. *Resolved*, that the secretary be directed to transmit a copy of these resolutions to the Council of the A. A. A. S."

The following resolution, presented by Professor Pierce, was unanimously adopted by a rising vote: "*Resolved*, that the Association extend a very cordial vote of thanks to Professor Aikins for the various courtesies and hospitalities which the members have so thoroughly enjoyed at his hands; and also that there be expressed to the Western Reserve University and especially to Professor Whitman the Association's appreciation of the adequate arrangements and accommodations provided in connection with the place of meeting."

On motion, the meeting adjourned.

#### REPORT OF THE TREASURER FOR THE YEAR 1912

Dr.		
To Balance from previous year.....	\$2,913.87	
Dues received from members.....	247.40	
Interest from July 1, 1911, to July 1, 1912.....	97.88	
Receipts from sales of Psychological Monographs No. 51 and No. 53.....	30.09	
		\$3,289.24
Cr.		
By Printing and supplies.....	\$ 107.36	
Postage.....	55.04	
Express and telegrams.....	7.58	
Reprints of Proceedings.....	25.44	
Reprints of Symposium on Psychology and Medical Education.....	12.00	
Clerical and stenographic aid.....	39.08	
Expenses of the Secretary (1911 meeting).....	51.74	
Expenses of apparatus exhibit (1911 meeting).....	14.35	
Appropriation for report of Committee on Mental Tests (Woodworth and Wells' Monograph).....	50.00	
Expenses of Committee on Teaching Experiments.....	6.25	
Exchange on checks.....	.40	
		\$ 369.24

Cash on hand.....	.05	
Balance in Fifth Avenue Bank.....	49.08	
Balance in Union Dime Savings Institution.....	2,870.87	
		\$2,920.00
		\$3,289.24

W. V. BINGHAM,  
Treasurer

HANOVER, N. H.,  
December 23, 1912.

Audited by the Council

## ABSTRACTS OF PAPERS

### GENERAL STUDIES

*Ideomotor Action.* Address of the President. EDWARD L. THORNDIKE, Columbia University.

The speaker described the various forms in which the doctrine of ideomotor action is now held true, and argued against the truth of the doctrine that an idea tends in and of itself to produce the act which it resembles. His argument was, that the facts alleged in support of this doctrine are all better accounted for by the laws of habit, pure and simple; that, experimentally, ideas of acts do not *per se* produce them; and that, in judgments of the potency of particular ideas, even the defenders of the doctrine abandon it. This last point was illustrated from the records of an experiment in measuring the belief of the Association as a group on certain significant issues. It was then shown that the doctrine of ideomotor action, even in its present most approved forms, is the descendant and homologue of primitive man's general belief in sympathetic magic—one of the relics of teleological thinking which psychology still cherishes.

(This paper will appear in full in the March number of the *PSYCHOLOGICAL REVIEW*.)

*Behavior as a Psychological Category.* JAMES R. ANGELL, University of Chicago.

Consciousness has been attacked from two directions. The philosophers have exhibited its metaphysical limitations while certain psychologists, especially the comparative psychologists, have urged the desirability of substituting for it some term like behavior.

Two main motives are to be noted in the psychological attack. First, the ambition to describe all conscious process in terms of objective behavior. Second, the distrust of introspection and the desire to replace it with other and more reliable scientific methods. Theoretically, it should be possible to state differences of mental conditions in terms of overt behavior. Practically, this is in some instances easy to do, in other instances extremely difficult. The frailties of introspection are real but hardly different in kind from those of other scientific methods—popular prejudice to the contrary notwithstanding. The criticisms of the psychoanalytic school are in part irrelevant, because they tend to confuse introspection as a method affording descriptions of conscious experience, with introspection as a method adequate to *explain* the presence of a given state of consciousness.

The tendency to enlarge objective modes of describing behavior ought to be encouraged inasmuch as it falls in line with the most substantial forms of scientific progress. The tendency to discount introspection, while wholesome in so far as it looks toward the betterment of methodological procedure, is premature, if not unjustifiable, in so far as it proposes to do away wholly with resort to introspection.

*Structure versus Function in Psychopathology.* E. E. SOUTHARD, Massachusetts Psychopathic Hospital.

*Demonstration of a Case of Amnesia.* H. AUSTIN AIKINS, Western Reserve University.

This case, discovered by Dr. Carlyle Pope, was studied in conjunction with Dr. Chas. W. Stone, Dr. J. S. Moore and others. H., present at meeting, is an attractive and gifted boy of 19, who was found unconscious on sidewalk at 2 A.M., November 8, 1912. Coming to 18 hours later, he said he had just been at his mother's funeral. Funeral actually took place sixteen months earlier, and H. had fallen unconscious when about to enter church. Examinations showed hysterical hypæsthesias, unstable emotions, deficient moral discipline and bad early associations.

Hypnoidal visions, easily induced at first and startlingly clear, all proved to come from important scenes in the lost period, though they seemed quite new and inexplicable to patient at the time. Association experiments with Jung's 100 words produced no perceptible fluctuations in galvanometer and very little variation in reaction time. The first 60 reactions in first experiment seemed to



indicate blocked associations (*e. g.*, cold—very, ask—anything, pity—much) and proved later to be highly significant. Subsequent reactions were usually visualizations, some of them at least from the lost period. Other glimpses of the lost period were had in dreams, natural or induced, and in two or three spontaneous day-dreams.

Starting with such clues as these and others supplied by his friends we resorted to hypnotism and gradually pushed towards both ends of the lost period, though it was weeks before we could get him to approach very near to either end of it. Even now in hypnosis H. is practically an alternating personality; he can tell about the lost period if started in it, but gets confused and awakens up if urged to pass either into it or out of it.

H.'s life during this period contained strong conflicting passions and interests, not very well controlled, in spite of an idealized sentimental friendship with another boy. It culminated in a dramatic struggle between friendship and moral indignation and in an open conflict with desperate degenerates that left him terror-stricken, exhausted and probably fainting where he was found.

In H.'s attitude towards mother, father, brothers and sisters Freudians would find a well-worked-out *Œdipus complex*, and in the image-content of adolescent night terrors attributed at first to a dog bite they would find strikingly significant symbolic substitutions.

H. is gradually getting hold of more and more of the lost period, but only as recollections of scenes in visions, dreams and hypnoses. Many of the events so far revealed are such as one might naturally wish to repress.

[The following note from Professor Aikins was received by the Secretary under date of January 17: "H's memory come back this morning. Last night we cleared away a bad set of buried memories at the beginning of the lost period. The others, you remember, were at the end."]

*Demonstration and Design of Apparatus to Simulate the Working of Nervous Discharges.* S. BENT RUSSELL, St. Louis.

First is given a theory for the working of nervous discharges and development of nervous channels. It does not consider definite molecular or chemical changes but rather advances "a mechanism of associative memory."

The second topic for discussion is based on the first and is a brief illustrated description of a practical mechanical device which will

represent the essential elements of a nervous system and which will react in the same way. Superficially the likeness of the device to a nervous system is not obvious but there are certain principles of action common to both.

Thirdly is given a demonstration of operations performed by the apparatus simulating inhibition, learning, habit-forming, etc.

The argument shows that a comparatively weak nervous channel may become a comparatively strong one if it be provided with two sensory endings and provided that outside occurrences shall cause the two endings to be excited in succession from time to time. In due course the originally weak channel will prevail over the originally strong channel and will control the muscular response. It is shown that converging channels will account for inhibition and diverging channels for association of ideas. The importance of counter signals or nervous impulses brought about by certain movements is pointed out. A form of satisfaction which is the antithesis of inhibition is explained by the effect of counter signals upon channel development.

The apparatus described is a hydraulic regulating system. The important parts are (1) a transmitter or triple slide valve with a timing attachment; (2) a measuring or balancing device governing a hydraulic cylinder or motor; (3) a system of key rods connected so that each key rod controls one or more transmitters and on the other hand each transmitter is controlled by one or more key rods.

*What a Student of Elementary Psychology Should be Taught Concerning the Functions of the Nervous System.* G. V. N. DEARBORN, Tufts College Medical School.

By request, the writer ventures the following suggestions as to the aspect of the nervous system essential at first to a student of psychology. *He should be taught:*

(1) Systematically and carefully the enormous *complexity* of the neuro-musculo-glandular mechanism and process, homologous to the indescribably complex mental procedure.

(2) The utter and misleading inadequacy of known central and axial localization to explain the actually experienced certainties of complexity, mental or bodily.

(3) That the sole function of the nervous system is to conduct influences as the means of coördination and integration.

(4) That the nervous system functionally viewed is a fabric, with separate pathways only in an anatomic sense.

(5) That, every moment of the mental process being "will,"

"feeling," and "intelligence" mixed, there is to be sought a more or less closely corresponding breadth in the nervous coördinations.

(6) The unified duality in the nervous system of the vegetative (phylenic, nutritional, habitual, actuating, spino-sympathetic, sub-conscious) and the personal (ontogenic, new, inhibitory, cortical, conscious).

(7) The hierarchy of nervous circuits (arbitrarily six, for example), each including more or less those beneath or within it, and influencing more or less those above it.

(8) The universality, both in time and space, of the cenesthetic influences coming into the central nervous system from the universally tonic or moving body, these waves of exciting energy constituting the reservoir from which the effective nervous energy is drawn, actuating and inhibitory.

(9) That the greater part of the neural fabric is continually determining and serving the subconscious personality as an unique set of purposes.

(10) That the nature of the nervous energy is still unknown, but that, whatever its variety, it (and not "traces" supposed to be "graven" in the material of the great cortex, 85 per cent. water) constitutes, in the form of *kinetic strains*, the chief immediate "physical basis" of memory, habit, meaning, and the rest.

(11) All possible really known details concerning the structure and the functions of the nervous system, and perhaps much more of the physiology of the receptors and the effectors than the majority of students ever learn.

(12) Psychologic students should be taught that it is better to be reasonably sure of a few of the basal general principles of the action of the neuro-musculo-glandular mechanism than to pretend an understanding in no way to be had from a relatively few isolated and uncertain facts of neural structure.

*Left-handedness and Right-handedness in Infancy.* MAX MEYER,  
University of Missouri.

The thesis of this paper is that left-handedness in infancy is a necessary accompaniment, in individual endowment, of right-handedness in adult life. The left-handedness of infancy is commonly enough observed, but it is nevertheless quite generally disbelieved. If a person who in adult life is known beyond doubt to be right-handed is reported by observers of his infancy to have been left-handed, then—so we reason—those observers must necessarily

have been in error, must have been unreliable; or the prevailing activity of the left hand, if accurately observed, must have been due to fortuitous circumstances forcing its use. This reasoning is not justifiable.

Here is an example of this erroneous interpretation. A classical example, it might be called. "In taking her out to her cab," Mrs. Helen Thompson Woolley says in the *PSYCHOL. REV.*, 1910, "the nurse always carried her on the left arm, leaving the child's left hand free, and as a result, she learned to wave Bye-Bye with the left hand. . . . By fifteen months, she had ceased using the left hand." If our ancestral inheritance could be so easily modified as Mrs. Woolley supposes, what an incentive this would be to enthusiastic educators!

I stated the fact of general left-handedness in infancy in my book on *Human Behavior* in 1911. So far as I know it has never been clearly recognized before. I have also indicated there a possible explanation. If the left cerebral hemisphere, which serves such complex functions as speech, reaches maturity, so to speak, only during the second year, it appears plausible to assume that during the first months of life hand movements are predominantly controlled by the right hemisphere which serves simpler functions and probably matures at an earlier time. General left-handedness in infancy would be the consequence as naturally as general right-handedness in adult life.

If the thesis is true, such attempts as that of Mr. H. C. Stevens (*PSYCHOL. REV.*, 1908) to explain right-handedness by regarding it as determined by an hypothetical superiority of histological equipment of the left halves of the retinae must fail, unless the histological equipment of the halves of the retinae is supposed to change places from the first to the second year. The superiority of the sense of sight on the right half of the field of vision, which Mr. Stevens has proved, is not the cause, but rather the effect of right-handedness, unless both are to be regarded as the effects of a common cause.

*Families of American Men of Science.* J. McKEEN CATTELL, Columbia University.

Statistics were presented in regard to the families of about a thousand of the leading men of science of the United States. Twelve per cent. are foreign born, 12 per cent. are native born of foreign parents and 7 per cent. have one foreign parent. Forty-three per cent. of the fathers belong to the professional classes, 21 per cent. to the agricultural classes, and 36 per cent. to the manufacturing and



business classes. Clergymen have the best record. The fathers were married at the average age of 26.6 years, they were on the average 35 years old at the time of the birth of their sons, and died at the average age of 70.6 years. Families of the class from which scientific men come had about 3.25 children; married scientific men whose families are complete have on the average 2.2 children. The percentage of deaths of children under five years is for the parents 14.8 and for the scientific men 7.5. The figures show a slight inheritance of fertility and a slight selective death rate against the larger families, but the correlations are very low. Mothers of large families live longer than mothers of small families. Scientific men coming from large or small families and those having relatively large or small families are in rank of about average standing, as are those unmarried. The first-born child has the best chance to become a scientific man. There are many cases in which scientific men are interrelated, and a large percentage of scientific men have relatives of distinction. A large mass of data concerning these and other factors was presented on tables. The discussion of the paper is concerned largely with the causes and effects of decreasing birth rates and death rates and on the extent to which scientific performance is determined by heredity or opportunity.

*The Separate Origins of Magic and of Religion.* JAMES H. LEUBA, Bryn Mawr College.

Three types of behavior have been developed by man:

1. *The Mechanical Behavior* is the method of dealing with things. It implies a quantitative relation between cause and effect.

2. *The Anthropopathic Behavior* includes (a) the common relations of men and animals with each other, and (b) those of men with unseen beings. When these beings are gods, we have religion.

The desired results depend upon an agent endowed with intelligence, and feeling.

3. *The Magical or Coercitive Mode of Behavior*, in which neither quantitative nor anthropopathic relations are involved. But magic may be used upon a personal agent. In that case the agent is neither prayed to, nor conciliated by offerings, but coerced.

Most of the varieties of magic may be accounted for by the following principles of explanation:

(a) Playful prohibitions. "If you do *this*," say our children, "*that* will happen to you." The "*this*" and "*that*" have usually no logical connection. Playful prohibitions may be taken in earnest and acquire a magical significance.



(b) Threats of untoward happenings made for the purpose of preserving things vital to the life and prosperity of the tribe.

(c) The deliberate treatment of certain situations according to magical principles, for instance, that like produces like. This source of magic is, of course, relatively a late one, since it presupposes that a principle of magical procedure has been disengaged from magical practices.

With regard to the *origin* of science, the author maintains, against Frazer, that the ancestor of science is not the magical but the mechanical behavior. The essential presupposition of science is that definite and constant *quantitative* relations exist. The clear recognition of that proposition means, whenever it appears, the death of magic and the birth of science. This fact indicates the opposition of the magical to the scientific attitude.<sup>1</sup>

*Magical and Religious Factors in the Development of the Human Will.*

FELIX KRUEGER, University of Halle.

Regarding *labor* as a continuous, purposive and organized activity, comparatively independent of accidental stimuli, primitive tribes work or labor far less than we. There are many facts, proving primitive man's *volitional inability* to work.

Under certain "irrational" conditions, and in magical or religious forms, we see him performing extensive and accurately regulated work. He tries to influence the weather, birth, sickness, prepares ritually for war or hunting. Primitive man's waking life is largely filled with dancing, singing and music,—not as mere amusement, but as expressions of emotional tension and as conventional, magically effective procedures. In human development, the beginnings of labor, in the psychological sense, are closely related to magical and religious ceremonies.

These are the first temporally, spatially and qualitatively regulated forms of social activity. The magical and religious performances are believed to be most effective and at the same time very dangerous. Such irrational regulations first teach self-restraint and sacrifice, independence from momentary stimuli—essential conditions to the will's development.

The procedures of the magician or medicine-man represent the first profession, of a single individual. From magico-religious qualities and taboo arise all primitive social privilege and every institution of group or personal property.

<sup>1</sup> See for developments Parts I. and II. of the author's book, *A Psychological Study of Religion; its Origin, Function and Future*, Macmillan, 1912.

All of these irrational relations are of utmost importance for the strengthening and deepening, for the individual as well as the social differentiation and integration of voluntary activity. Originally disconnected magical stirrings organize themselves into social conventions, political institutions and economic practices, into moral and æsthetic feelings, into religious forms of reaction, in the proper sense of this word.<sup>1</sup>

*The Study of Man.* Vice-presidential address before Section H.  
GEO. TRUMBULL LADD, New Haven.

The discussion is introduced by reference to the conversation between Socrates and Theætetus as to the meaning of the celebrated maxim of Protagoras: "Man is the measure of all things; of that which is, how it is; and of that which is not, how it is not." The meaning and truth of the maxim can be determined only by the study of the "measurer,"—that is, the study of man. The cordial coöperation of the two sciences of psychology and anthropology—as represented by this section—is indispensable for the successful prosecution of this study. Psychology cannot study the individual man, on his mental as well as on his physical side, without studying him as a member of the race. But anthropology is, in its turn, confessedly dependent upon psychology as one of the most important, if not the most important, of its contributory sciences. From both points of view we see that no doctrine of the relativity of knowledge can be maintained which regards knowledge itself as a process, largely or mainly receptive on a basis of sensations. Instinctive and intuition elements, emotional factors, and the activity of intellect, according to its constitutional and, so far as we know, unalterable laws, enters into all science, as well as so-called practical knowledge. But having, at least in a preliminary way, determined the meaning and the truth of any of the current doctrines as to the relativity of knowledge, we are ready to see what are some of the more fundamental relations in which psychology and anthropology, as co-operative in the study of man, stand to all the positive sciences. Such relations are, chiefly, these three: (1) The determining, in a general way, the method of science; (2) the fixing of the limitations of science; (3) the setting-forth and defence of the ideals of science. Each of these topics is then made the subject of a brief discussion, and the paper closes with one or two practical remarks as to the

<sup>1</sup> This paper will appear in full in one of the first numbers of the *Arbeiten zur Entwicklungs-Psychologie*, Leipzig, Engelmann, 1913 ff.

spirit in which the two sciences, in conducting the study of man, should coöperate.

#### STUDIES IN EXPERIMENTAL PSYCHOLOGY

##### *The Relative Value of the Eye and of the Arm in Spatial Relocalization.*

H. F. ADAMS, the University of Michigan.

The purpose of the experiment was to test, if possible, the accuracy of the theory held by Wundt, Dodge, and many others, that the kinæsthetic sensations from the external eye muscles are of no use in giving us awareness of position. If this theory is true, how is it possible to relocate a position more accurately with the eyes than with the arm, for no one denies that the kinæsthetic sensations from the arm muscles are of considerable importance in giving us spatial data.

The fixation throughout lasted 5 seconds. The intervals between fixation and refixation varied from 5 to 30 seconds. During the interfixation period the members were sometimes moving and sometimes stationary.

With the members stationary during the interfixation period of 5 seconds, the average error of the eye and of the arm refixations was about equal, there being but 0.1 degree in favor of the arm. There is, however, a considerable variation between subjects. With the members moving at random during a 5 second interfixation period, the eye is almost twice as accurate as the hand, the average error of the former being 1.206 degrees, and of the latter, 2.086 degrees.

The duration of the interfixation period with the members stationary exerts a considerable influence, much more marked with the hand than with the eye. The same thing is true when the member is moving during the interfixation interval, though the error is much more marked, being in some cases more than double what it is when the member is stationary.

The direction in which the members move also exerts some influence upon the accuracy of the refixation. When the members move freely, the average error is least of all of the refixations after movement. The error after a movement to the right is less than after a movement to the left; and the error after a movement upward is less than after a movement downward.

The error after a movement to a definite mark is greater than an unregulated movement in the same direction.

The error of the eye-hand coördination is greater than either the

hand-hand or the eye-eye coördination, and increases rather regularly with increasing duration of the interfixation pauses. Oddly enough, the eye-hand coördination in indirect vision is less than it is in direct vision. In indirect vision, the error varies directly with the eccentricity of the stimulus.

In general, two sorts of cues are used in the refixations, the first being kinæsthetic, the second, visual imagery of one sort or another.

*Studies in Association and Inhibition.* JOHN F. SHEPARD, University of Michigan.

Introspection indicates that in the preparation of the subject for the simple reaction experiment both stimulus and action are present together in consciousness and they are parts of a whole. This wholeness consists in the fact that the stimulus or representation of the stimulus tends to arouse the act by association and yet that an incompleteness or variation of the stimulus inhibits the act. We seem to have a form of inhibition here which could not be brought under the concept of drainage or division of energy. No connection or path has been formed which could rival that already "sub-excited" between the representation of the stimulus and the reaction. An attempt was therefore made to investigate the possibility and laws of inhibitions where there is no division of established connections or where the connections established work toward the same end.

Nonsense syllables were used. Associations learned between the syllables were combined in several ways such that the rearousal effects should reinforce each other if association were a mere path of lowered resistance. Instead of reinforcement, inhibitions were found. The results indicate that an association involves other processes besides certain lowered resistances. These processes prevent any other stimulus from using the same neurones at the same time, check the response if there is any variation or incompleteness in the recalling stimulus, and block any other associations that are tending to operate at the same time even though both lead to the same end result. The introspections seem to show that we may identify attention and this association-inhibition process; the unit of attention is not a simple sensory or simple motor process, but is an association process.

Further experiments in association by similarity suggested that the excitation and inhibition sides of association force the distinction of likenesses and differences in the reasoning process.



*The Varying Forms of Attention in Tachistoscopic Reading and in the Reaction Experiment.* RUDOLF PINTNER, University of Toledo.

The object of the experiments was to investigate the individual differences in the attention process during reading and to compare these with the individual differences in reaction. It was found in the reading experiments that observers could be classified according as they tended to fixate sharply or to allow their attention to fluctuate. Characteristic differences in the manner of reading resulted from these different forms of attention. No hard and fast line can be drawn between fixating and fluctuating readers. Children tend on the whole to belong to the fluctuating class, but even among very young children fixating readers are occasionally found.

In the reaction experiments three types of reactors were distinguished—sensorial, muscular, and natural. A common characteristic of the first two types is that the mean variation of the reaction times is comparatively small, whereas the mean variation of the natural reactor is comparatively large. Represented graphically the first two types show curves with one summit; the natural type shows curves with two or more summits. It was found that the fluctuating reader approximated to the type of natural reactor. The fixating reader on the other hand was either sensorial or muscular in his reaction. This would be explained by the fact that he fixated sharply either the stimulus or the action to be carried out. The fluctuating reader or natural reactor would seem to let his attention wander between the stimulus and the action. The correlation between fluctuating reading and natural reaction and conversely between fixating reading and muscular or sensorial reaction was found to be very high with adults, but not so high with children.

The experiments seemed to show that individual differences in the attention process are fundamental to the character of the individual and that they will show themselves in all psychological processes and influence the response of the individual to any stimulus.

*Experimental Criteria for Differentiating Memory and Imagination in Projected Visual Images.* R. M. OGDEN, University of Tennessee.

These results are based upon introspective analyses obtained from 6 observers in 250 experiments. They comprise 138 memory images (*M*'s), and 74 images of imagination (*I*'s). The instruction called for the fixation of a circular disk of "granite" paper 2 cm. in diameter, exposed in a card-changer at approximately 30 cm. distance



from the observer's eyes. When the card appeared the observer was to try to get a visual image suggested by a word printed below the disk, and to react as soon as the image became clear and definite.

(1) An attempt to study the eye movements involved, by means of distraction marks placed upon the cards outside the disk, failed to bring results.

(2) The projection of images was found to be a simple task. But one observer reported images (5) located "in his head," and only 22 images were reported without definite location. The principal types of location were: I. Location upon the disk; II. Location in space near the observer; III. Location at a distance. *M*'s tend generally toward Location III., and *P*'s more strongly towards Location I.; although both may be projected in all three locations. This seems to agree with Perky, rather than with Koffka and Martin.

(3) The presence and absence of color did not reveal any marked correlation with either *M*'s or *P*'s.

(4) Feelings were very infrequent; when present they attached to *M*'s.

(5) *M*'s were reported as distinct in a larger proportion of cases than *P*'s, in opposition to Perky's results, and agreeing with Martin.

(6) The images of both categories were more often mediated by an introductory thought, than spontaneous. *M*'s were more often spontaneous than *P*'s, agreeing with Martin.

(7) The above is also attested by a shorter average reaction-time for *M*'s than for *P*'s, which opposes Perky's results.

(8) Associations were not found to be more frequent accompaniments of *M*'s than of *P*'s as Martin and Perky report.

*Quantitative Investigation of the Relation between the Anschaulich and Unanschaulich Contents of Consciousness.* LILLIEN J. MARTIN, Stanford University.

The following experiments grew out of a desire to test certain conclusions drawn from introspections given to protocol during a recent investigation of the projection method and the location of visual images. The experiments fall into two series.

*Material and Method.*—Simple figures cut from a school drawing-book and mounted on cards. Each card was shown to the *Vp* from 5-20 seconds. He was then asked to draw his visual image, if he had one, (*B*), and to state how it arose. Immediately after completing this drawing (*B*), the *Vp* was asked to draw the figure on the card as he remembered it (*U*). *U* represents then what is regarded

as correct in the corresponding image ( $B$ ) and anything additional that the  $Vp$  knew in regard to the figure on the card. The  $Vp$  was questioned as to the presence of other than visual images. The results are given in tables. The tables give the number of divisions in the lines of the cards which had been counted, and their lengths which had been measured in cm. Similar data are given for the  $Vpn$ 's drawings for  $B$  and  $U$  for the cards.

*Discussion of the Tables.*—If we exclude all cases where there were other images than visual the results of the tables show (1) That often  $U$  is more correct than  $B$ . (2) That sometimes  $U$  is as correct as  $B$ . (3) That for every card and every  $Vp$  except one,  $U$  is more correct than  $B$  at some time. (4) That  $B = 0$  5 times but that  $U$  does not = 0 at any time. (5)  $U > B$  occurs 3 times out of 164.

*Discussion of the Drawings.*—Plates in which the drawings made for  $B$  are reproduced furnish still further proof of an unanschaulich memory. One sees (1) That in different individuals  $B$  may differ greatly where the  $U$ 's do not differ materially. (2) The same thing is seen in the case of the same individual. (3) In some cases  $B$  is but a fragment and yet  $U$  is more complete than in other cases where  $B$  is a fairly complete image. (4)  $B$ 's of like completeness but of different spatial arrangement give the same  $U$ . (5) In two cases the parts of the image as shown on the plate arose successively, and yet it was not supposed by the  $Vp$  that the parts of the figure on the card had a relation of succession to each other. (6) On the plate are shown irrelevant images, that is, images that were not those of the card.  $U$ , however, was not affected by  $B$ . (7) The plate gives a case where an after-image arose and where it was the only image that arose for this card.  $U$  in this case was approximately correct. (8) Of the correcting power of  $U$  the plates also give evidence.

*Discussion of the Introspections.*—The introspections furnish additional proof not alone for the existence of an unanschaulich memory but of the fact that it actually gives rise to the visual image which is so often supposed to be that to which the memory is traceable.

*Concerning the Function of a Visual Image in Memory and Imagination.*

LILLIEN J. MARTIN, Stanford University.

The relation of the image to the imageless memory of a particular card can be shown by a diagram in which  $C$  the outer circle includes the content of a particular card to be remembered,  $U$  the inner circle, the unanschaulich memory of the card and  $B$  the inmost circle, the image arising in connection with the remembrance of the card. It is

evident from the results of the experiments just discussed that in case of some other cards or some other  $Vp$ ,  $U$  could =  $C$  in area, or  $B$  could =  $C$  in area or both could =  $C$  or  $U$  could include more of  $C$  ( $U > B$ ) than  $B$  or just as much of  $C$  ( $U = B$ ) as  $B$  or less of  $C$  than  $B$  ( $U < B$ ). It would seem from the previous experiments that where  $B$  contains more of  $C$  than  $U$ ,  $B$  could be considered an (1) information bringer; where it contains the same amount of  $C$  as  $U$  (2) that it acts as an emphasize of what is remembered; that where  $B$  is very fragmentary (3) it acts as an aid to the attention, serving the same purpose as does a fixation point in darkroom experiments; and where  $B$  came after or grew out of  $U$ , as the introspections of the experiments just described sometimes show to have been the case, that (4) the arising of  $B$  was proof to the  $Vp$  remembering that the assigned task had been fulfilled.

Certain characteristics of  $U$  support the idea that  $B$  acts as an attention holder. (1)  $U$  is in general marked by a certain quickness, vividness, flash-like character. (2) Again  $U$  has a massive and undifferentiated character. It gives an impression of richness of content.  $B$ , through offering a fixation point, serves as a speed reducer and delay of  $U$ .—Through  $B$ 's aid  $U$  is given an opportunity to develop, to become more differentiated.

A series of experiments recently made to obtain further information regarding the effect of questioning the  $Vp$ , furnishes valuable proof of the function of  $B$  as, (1) an aid to the attention, and (2) as a proof to the  $Vp$  that the task set has been completed. The method was to direct the  $Vp$  to get an image, for example, of a lady in evening dress, and such questions were put to him as, Is the dress yellow, red, etc.? The  $Vp$  reported the effect of the question upon the image and its background. The introspections show that while  $B$  was affected in various ways by the questions  $U$  remained unaltered. It is evident from the results that in discussing the suggestive effect of questioning one must state whether he is referring to the unanschaulich or anschaulich memory.

*The Mental Imagery of Two Blind Subjects.* MABEL RUTH FERNALD,  
Chicago Normal School.

The mental imagery of two blind subjects (university students) was studied by methods used by the author with normal subjects, with translation from visual to Braille symbols when necessary. The attempt was made to determine (1) whether visual imagery was used, (2) whether tactual imagery appeared, and (3) what differences existed between the two subjects.

One subject (*A*) has been almost blind from birth and completely so since her seventh year, while the other (*B*) has partial, though very slight, vision—a condition which has existed since her second year. The main differences to be noted, therefore, in general training are: (1) Though both have to depend entirely on touch and tactual symbols for their present reading, *B* learned first by visual symbols and used these slightly until her twelfth year, while *A* never knew any but the tactual symbols. (2) *B* has had a more extensive, though crude, visual acquaintance with objects in general and still depends upon this field of sensory material. Such visual experiences as *A* had before her seventh year were quite inadequate, and she has had none since then.

*Non-verbal Imagery.*—The results indicate that *B* uses an abundance of visual imagery, as well as auditory, with some olfactory, gustatory, kinæsthetic, etc. Tactual was mentioned only twice. *A* never uses visual imagery spontaneously and is uncertain about the visual suggested in a questionnaire. She is dubious as to whether she ever gets imagery of colors. Tactual and kinæsthetic imagery are plentiful, as well as auditory, temperature and olfactory.

*Verbal Imagery.*—Both subjects make much use of auditory-vocal-motor imagery. Where these are inadequate *B* uses visual imagery, usually of the Braille forms. Tactual images of the Braille symbols did not appear to be stimulated. On the other hand, *A* showed no use of visual imagery but relied upon tactual-kinæsthetic to make the discrimination when necessary.

So far as these two subjects were concerned, therefore, it appears that a decided positive emphasis on tactual sensory experiences during adult life was not effective in stimulating tactual imagery for the subject who was able to translate these into visual terms, while the subject who had no such resource used tactual imagery with readiness and success.

*Consonance and Dissonance.* FELIX KRUEGER, University of Halle.

(A summary of this paper will appear in the *Journal of Philosophy, Psychology and Scientific Methods* for February 27, 1913.)

*The Place of Stimulation in the Cochlea vs. the Frequency of Vibration as a Direct Determiner of Pitch.* JOSEPH PETERSON, University of Utah.

This paper reviews critically various theories of hearing with respect to their bearing upon the specific energy of the cochlear



branch of the auditory nerve. Besides failing to account for certain secondary phenomena of hearing, most of the theories reviewed do not adequately explain such pathological phenomena as tonal islands. Ebbinghaus's modified resonance theory rests upon mutually contradictory assumptions. It is noted that resonance theories do not necessarily assume specific energy of nerves, while on the other hand some non-resonance theories do assume specific energy.

There seems to be a need for a specific energy interpretation. The basic assumptions of the Helmholtzian theory seem to answer the need best. Some of the early objections to Helmholtz's theory have been removed by advance in experimental methods. Of difficulties still in the way of this theory this paper considers (1) its unsatisfactory explanation of intensity relations of combination tones, (2) the easy drowning out or obliteration of a weak high tone by a lower tone, (3) the experiencing by the ear of phase-difference in tones. It has been shown that we can locate tones below a certain pitch largely or entirely on the basis of phase differences of the vibrations in the two ears. Lord Rayleigh regards this fact as sufficient to discredit the whole resonance hypothesis.

This paper attempts theoretically to meet the first objection, and refutes the second on experimental evidence. It has heretofore been shown that a low tone easily obliterates a high weak one when the two vibration-series operate in the same ear through the ossicles, and that it cannot drown out the high tone when the vibration series fall one upon each ear, so that the two cannot operate on the same tympanum. These facts are verified, but this additional point is discovered: when two sounding forks are placed in contact with the skull or the teeth so that both vibration-series, by means of bone conduction, operate together in either ear, the low tone cannot easily obliterate the high weak one. A low-frequency vibration evidently dampens or destroys a more rapid weak one in the transmission through the ossicles. The facts alleged in objection (3) are apparently correct in the main. Reasons are given why these facts are not fatal to the resonance hypothesis. A high degree of resonance is out of the question. Somehow the cortical center seems to register in consciousness any lack of simultaneity in the impulses from the two ears reaching this center.

*Foveal Vision as Influenced by Bright Surroundings.* PERCY W. COBB and L. R. GEISSLER, National Electric Lamp Association, Cleveland.



A uniformly bright field  $6 \times 8$  cm. was prepared, trans-illuminated from a second room and observed with one eye at 2 meters' distance. The brightness could be accurately controlled and measured. This was arranged so as to give place for a definite observation period to a test-field (*a*) in which one half was a small and measurable amount brighter or darker than the other half (*b*) in which a system of parallel lines of variable width appeared. The test-field was always equally bright to the blank field and both were constant for any particular set of experiments.

A set of bright surroundings for this field was obtained by observing through a hole in the further side of a box, the face of the observer being held in an opening in the near side. The interior of the box (a 26-sided polyhedron, approaching a spherical shape) was whitened and illuminated in such a way that the whole visual field was filled with a nearly uniformly bright surface.

The following sets of determinations were made by two observers, G and C: (*a*) with dark surroundings, parallel brightness-difference and visual acuity observations at seven points, the test object varying in brightness from 0.00437 to 68.3 candle-power per square meter. (*b*) with surroundings at 42 c.p. per sq. meter, a similar set at five points in which the test-object varied from 1.51 to 64.3 c.p. per sq. meter.

*Results.*—A constant individual difference was that toward the lower limit of vision observer C uniformly required a greater brightness of test-object for equal distinctness of vision than G, namely, from 1.6 to 4.25 times as great under the different sets of conditions.

Two results were noted as due to the bright surroundings: (*a*) The lower limit of vision came about at much higher brightness of test-object in the case of bright surroundings, *i. e.*, these latter were here *unfavorable* to the eye. (*b*) With the highest brightness of test-object the results showed a difference *favorable* to the eye in the case of the bright surroundings.

*Experiments on Color Saturation.* L. R. GEISSLER, University of Georgia.

This study was made in the physical laboratory of the National Electric Lamp Association, in Cleveland.

In the first group of experiments a deep red on the inner disc of a Lummer-Brodhun color-mixer was gradually reduced in saturation by adding small amounts of gray of the same tint as the color until it looked just noticeably less saturated than the pure red on the out-

side ring. Then the latter was made equal to the inside, which was then again reduced until it was just different from the outside. This was continued between  $360^\circ$  and  $300^\circ$ ,  $240^\circ$  and  $220^\circ$ , and  $115^\circ$  and  $105^\circ$ . The corresponding stimulus differences decreased from  $11^\circ$  at  $360^\circ$  to  $4^\circ$  at  $330^\circ$  and from here remained practically constant. On this experimental basis and by the aid of interpolation the total number of just noticeable differences between the color limen and the maximally saturated pigment-color red was determined to be about 100. For still more saturated colors the number would probably be greater, and conversely.

The purpose of the second group of experiments was to determine the color-limen for red, green, yellow, and blue with a large number and variety of observers and for both eyes as well as for each eye separately. The method was similar to the first. The combined results of binocular and monocular vision for all nine observers showed that the more saturated the original color, the lower or smaller is its visibility limen, that is, of the most saturated color, red,  $2.12^\circ + 357.88^\circ$  gray of equal tint in the inside looked just barely colored as compared with  $360^\circ$  gray on the outside. Expressing the results in percentage, we get for red .60 per cent.  $\pm .24$ , for blue .82 per cent.  $\pm .36$ , for yellow 1.60 per cent.  $\pm .58$ , and for green 1.95 per cent.  $\pm .49$ . These figures afford us therefore a fairly accurate and simple means of determining the saturation-ratios of different colors, and if a certain color could be agreed upon for a standard, our method could furnish also an absolute measurement of color-saturation. Our experiments are also suited to bring out individual peculiarities, of color-weakness, for example, as the three observers to whom blue looked either equally much or more saturated than red gave also a lower limen for blue. Neither age nor long experience with colors seems to influence the color-limen, but the two women observers gave, if anything, slightly larger values than the seven men. The binocular averages were considerably smaller than the monocular, and the right eye gave lower averages than the left eye. For binocular as well as for monocular vision the order of the colors remained the same.<sup>1</sup>

*Keyboard Puzzle Box and Apparatus for Experimental Phonetics.*

JOHN F. SHEPARD, University of Michigan.

The keyboard is composed of two rows of keys, eighteen in all, arranged similarly to the keys of a typewriter. The door of the

<sup>1</sup>This paper will appear in full in the April number of the *American Journal of Psychology*.

problem box is held shut by a sliding bar which runs lengthwise of the keyboard under the arms of the keys. A series of triangular clips can be set at any desired positions on the bar. The under edges of the key arms are beveled. When one of the clips comes under a key arm, depression of the key will then move the bar one notch. The clips can be so arranged that a certain number of keys pressed in a certain order will open the door.

The apparatus for experimental phonetics consists of several pieces. The first is a speech receiving instrument. In it are two chambers packed with cotton to prevent resonance, and having an opening which fits airtight around the mouth and nose of the subject. The receiving chambers for the mouth and nose are separate. The escape from each chamber is regulated by a graduated opening. The changes of pressure in each chamber are recorded by tambours with tightly stretched rubbers. With constant escape the records are, then, a function of the outflow with speech.

Tubes also run from in front of the mouth and nose out of the chambers to tone recorders. Two new designs of tone recorders are used. One of these forms is an adaptation of the piston recorder. The other records the vibrations of a circular piece of mica placed over a shallow receiving chamber and attached to a ring of rubber around the edge. In both forms a new recording vibrator is used. It is made of two pieces of quill about a millimeter wide, scraped thin, and glued end to end with the cross diameters at right angles to each other. With this arrangement the bending will be confined to the piece fastened in the holder, and the needle will move as a whole and not vibrate in sections.

The larynx movements are recorded by a new laryngograph which fastens to the head and neck and does not rest upon the chest. It also prevents the head from moving with reference to the throat and larynx.

#### EXPERIMENTAL STUDIES IN ANIMAL PSYCHOLOGY

*Some Sensory Factors in the Maze.* STELLA B. VINCENT, University of Chicago.

This paper reports some experimental work on the maze problem in which the method used was the opposite of that employed by Professor Watson in "Kinæsthetic and Organic Sensations," namely, the addition instead of the subtraction of stimuli. In the one group of experiments the true path and the false were made to differ so far

as possible in brightness. In the other group an olfactory trail was laid alternately in the true and false pathways.

The results showed a lessening of initial time and errors and a decrease of total errors. As a whole, though, the final speed and accuracy was less than that found in the normal maze. The learning curves were very different.

The conclusions are that if animals are given two contrasting sensory paths side by side, the one path may prove more dominant and favor speed and accuracy in the early trails prior to any effects of learning. After the problem is learned, in the slow turning over to kinæsthesia, when attention is freed, these sensory factors may still retain their potency in times of momentary distraction. The result is a less perfect automatism and a slower speed.

*The Delayed Reaction in Animals and Children.* WALTER S. HUNTER, University of Texas.

The reagents used were white rats, dogs, raccoons and children. Associations were set up between getting food (or candy) and a light which might appear in any one of three directive positions. Tests were then made in which the light was turned off before the reagents were permitted to react. During the interval of delay, the subjects were confined in a release box from which all three light boxes could be seen. The interval of delay between turning off the light and releasing the subject was gradually increased until the maximal limit of delay was obtained. In addition data were secured on the method used in solving the problem.

The maximal delays of the various reagents varied as follows: rats, no learning—10 secs.; dogs, 2 secs.—5 mins.; raccoons, 3 secs.—25 secs.; children, 50 secs.—25 mins.

There were no two or three objective stimuli which were presented simultaneously at each trial (such as the three spatial locations of the boxes) that could serve to determine the reactions. Such stimuli could not indicate where the light had been most recently. Differential responses must have alternating and not simultaneous cues.

A series of controls demonstrated that in the absence of the light there was nothing in the external environment that alternated from trial to trial which could serve as a guiding cue for the reactions. It follows from this that in successful responses some representative substitutes for the three positions of the light must be developed from within the subjects' bodies and used.

The rats and dogs solved the problem by maintaining gross motor



attitudes of the whole or part of the body. If this attitude were lost, the reaction failed. The raccoons depended upon such cues for the majority of their reactions; but of those responses made from wrong body orientations, too large a number succeeded to be attributed solely to chance. This and the following reasons force one to attribute to the raccoons the use of some internal cue other than gross motor attitude. (1) Correct reactions might be made in direct opposition to orientation. (2) Different correct reactions might be made from the same orientation. (3) The same correct reactions might be made from different orientations. And (4) wrong reactions often resulted from correct orientations.

The children were never dependent upon gross motor attitudes.

The behavior of the rats and dogs can be stated in terms of habit; but that of the raccoons and children requires the assumption of an ideational function whose content may be regarded either as sensory or as imaginal, depending largely upon the interpreter's psychological prejudices.

*Some Reactions of Raccoons to a Temporal Series of Stimuli.* F. M. GREGG and C. A. MCPHEETERS, University of Chicago.

Professor Cole, of the University of Oklahoma, in experimenting with raccoons, taught them to discriminate between two series of color cards, each series consisting of three cards, presented to the animal in succession.<sup>1</sup> It was assumed that the animals reacted to all three cards, the first and second being present as memory images and the third actually present when the reaction occurred.

This experiment was repeated and the assumptions tested. First. The animals were taught to discriminate between the two series of color cards, white blue red, and red red red (Professor Cole's series). Second. Controls were employed to discover if there were other factors than color influencing the reactions of the animals, and if so what they were.

*Controls.*—(1) Cards were shown in the customary order, but were attached to different levers. (2) Cards were shown in various orders, being changed from one lever to another, but the order of the levers remained the same as that which the animal had learned. (3) The positions of the levers were changed, levers were washed, and fresh color cards were used. The cards and levers were presented in the customary order. (4) Entirely different colors were used, but the levers were operated in the customary order. (5) The levers were

<sup>1</sup> *J. Comp. Neurol.*, Vol. XVII., pp. 255 ff.

operated by another person than the one usually operating them.  
(6) Glass was placed immediately in front of levers and color cards.  
(7) The levers were operated without any cards attached.

*Conclusion.*—The animal was not reacting to color but to the position of the levers.

Further tests were made to determine if the animal was reacting to all of the levers or to only a part of them.

*Conclusion.*—The animal was reacting mainly to the first of the series, was possibly influenced by the second, but not at all by the third.

*On Sound Discrimination by Cats.* W. T. SHEPHERD, Washington, D. C.

The paper is a report of experiments made on cats, to ascertain their ability to discriminate musical pitch and to discriminate "noise." The tests include: Experiments on (1) discrimination of notes of a difference of two octaves of pitch on a harmonica; (2) discrimination of notes of a difference of one octave of pitch on a harmonica; (3) discrimination of notes of a difference of two octaves of pitch on a piano; (4) discrimination of different intensities in noise.

One individual employed was eighteen months old. It had received previous training only in some experiments on discrimination of articulate sounds, completed nine months previously. The other animal was about four years old. It had received similar training at the same time as the first cat. Both were gray house cats. Both were of medium intelligence.

The experimenter sounded a certain note, or made a noise of a certain intensity (approximate), waited ten seconds for a response, then fed the animal. In conjunction with the "feed" note, or the "feed" noise, other notes were sounded, or a noise of a different intensity was made, whereat the animal was not fed. The cat was to show its discrimination of the pitch of the notes, or of the different intensities of the noises, by reacting in a definite manner to the feed note, such as rearing up and looking through the top of the cage for food to be given it, and by not so reacting to the other notes or to the other noise.

In Experiment 1, the younger animal showed indications of forming the association in the first day's trials. On the second day, or in 45 trials in all, it had perfected the association. The older cat first showed indications of forming the association on the third day. The latter perfected the association the seventh day, in 90 trials in all.

In Experiment 2, the younger animal learned to discriminate a difference of one octave of pitch on a harmonica in two days, or in 30 trials in all.

In Experiment 3, the younger cat formed the association in two days, or in 40 trials.

In Experiment 4, the same cat discriminated noises in two days, or in 40 trials.

The writer concludes that cats are able to discriminate pitch and also noise.

Raccoons, in tests similar to Exp. 1, took 100 and 150 trials. Two *Rhesus* monkeys, in similar tests, required, respectively, 30 and 40 trials to perfect the association.

*Experiments upon the Chick's Spectrum.* JOHN B. WATSON, Johns Hopkins University.

The chick's spectrum ends in the red region at about  $\lambda=7,150$ ; in the violet, at about  $\lambda=4,000$ .

The reaction thresholds were taken throughout the spectrum with stimuli of known energy. Thresholds of two human subjects were taken under conditions approximately the same as those maintained for the chicks. The sensitivity curves of the chicks and of the human beings thus obtained are almost identical in form. No justification was found for Hess's statements to the effect that the chick is blind to blue and violet rays.

In carrying out this work, it was found that no single spectrometer system gave monochromatic bands of sufficient purity (freedom from admixture with white light) for making threshold tests. In order to eliminate white light, it was found necessary to pass the band issuing from the selecting slit of the first spectrometer through a second spectrometer (purified spectrum of Helmholtz). The intensity of the light was cut to threshold values by means of the Brodhun sector. With this instrument, the intensity of the light can be changed while the sector is in operation.

The experiment box employed was similar to that devised by Yerkes. It was fitted with automatic signalling devices which enabled the experimenter to obtain records of the time elapsing between the exit from the home box and the right or wrong choice.

The work was done under the auspices of the Marine Biological Laboratory of the Carnegie Institution, under the direction of Dr. Alfred G. Mayer.

*Brightness Vision in the English Sparrow.* EUPHA FOLEY TUGMAN, University of Indiana.

*A Comparative Study of the Intelligence of Normal and Inbred White Rats.* GARDNER C. BASSET, Johns Hopkins University.

*The Relation of Accuracy and Speed in Practice: a Study in Conscious Attitudes.* M. E. HAGGERTY and H. L. SMITH, Indiana University.

*The Relative Effects of Maturation and Use on the Development of an Instinct.* J. F. SHEPARD and F. S. BREED, University of Michigan.

In a previous study of the pecking instinct of barred Plymouth Rock chicks data were gathered from which a curve of development of the instinct was plotted. This curve represents the improvement in accuracy of the pecking coördination from the second to the twenty-fifth day. With this curve as a standard an attempt was now made to determine the relative amounts contributed by maturation and use to this improvement. Two lots of chicks, divided into five groups, in all twenty-three in number, were tested. By confinement in a dark-room prior to the first tests practice was prevented for a definite time in each group—three, four, or five days from date of hatching. Meanwhile the animals were fed and watered artificially. The most interesting features of the results are (1) the equally poor initial records, and (2) the rapidity with which normal accuracy was attained. Regardless of the duration of the period of confinement, within the limits specified, the chicks began below an efficiency of 18 per cent. and with from one to two days' practice reached normal efficiency. In the first two days of the curves the necessary practice component, it seems, is represented, and in the remainder a record mainly of maturation. This inherited disposition is apparently not comparable throughout to a partially developed habit.

#### STUDIES IN EDUCATIONAL AND APPLIED PSYCHOLOGY

*The Need of a Dual Standard in Testing Handwriting.* FRANK N. FREEMAN, University of Chicago.

It is necessary to include in an adequate test of handwriting a measure of speed as well as of quality or legibility, first, because both characteristics are indispensable from the point of view of practical importance. Furthermore, neither alone is an adequate basis for test because their relation is not a constant one, but varies in different ways. This variation is manifested whether we compare different school grades in the same school, the same grade at different times of



the year, different schools, or individuals with one another. In order to determine whether the writing of an individual, a grade, or a school is good, or whether the teaching of a teacher is efficient, it is therefore necessary to measure both the quality and the speed of writing.

*Economical Learning.* W. H. PYLE, University of Missouri.

The object of this investigation was to determine the proper length of period and the proper distribution of periods in drill or habit-formation. The experiments were begun in February, 1910, and have been continued to the present time; the subjects—at all times as many as eight or ten—were mostly seniors in the University of Missouri, and the practice has been in typewriting, shorthand, memory work and in learning to write in arbitrary characters instead of with the ordinary alphabet. The method was to give the subjects practice for a certain length of time, requiring all to use the same procedure, then the subjects were divided into two groups. One group was then given practice using the same procedure as before, while the other group used the method then being tested. The first or control served to give a measure of ability of the subjects when using the same method. After this method was perfected, the only material used was the arbitrary alphabets which seemed best to serve the purposes of the experiment.

The results, in brief, are as follows: On the whole, 30 minutes seems to be the best length of practice period. In some cases, shorter periods seem a trifle more advantageous, especially in the early stage of practice or habituation. But, generally speaking, one gets ample returns in habituation for practicing up to the point of fatigue, which, in our experiments proves to be 30 or 40 minutes for most subjects. Eighty minutes, the longest period used, proved decidedly disadvantageous, especially in the early stage of habituation. Generally speaking, daily practice seems to give better returns than the same number of periods distributed on alternate days or in twice-a-day periods. However, there is some evidence that in the early stage of habituation, the second practice on the same day gives good returns and that, later on, alternate days may be the best distribution. While practicing twice a day does not give, on the average, as good returns as once a day, if we count the same number of periods, it gives much better returns if we count the number of days, the subjects, of course, having twice as much practice as those working once a day. That is to say, if one does not count the time, it pays to practice twice a day, at least till we gain considerable efficiency.

*Reliability and Distribution of Grades.* DANIEL STARCH, University of Wisconsin.

Considering grades as a scale of measurement, two problems arise: How small steps are distinguishable and what proportion of persons should ordinarily receive the various grades? The fineness of the scale depends upon the reliability of the assignment of grades. This latter was determined by having two papers in English work graded by 142 teachers of English and one paper in geometry graded by 118 teachers of geometry. The grades of one English paper ranged from 64 to 98 with a probable error of 4.0. The grades of the other ranged from 50 to 98 with a probable error of 4.8. The grades of the geometry paper ranged from 28 to 92 with a probable error of 7.5. To discover whether this wide variation might be due to the difference in standard among the schools, ten freshman English papers were graded by ten instructors of freshman English in the same institution. The mean variation of all these grades was 5.3 which is not materially different from the above variations. In order to eliminate the variation due to differences in standards among individual instructors, all the marks were weighted by the amount that each individual differed from the general average. The mean variation of these weighted grades was 4.2.

In order to compare the accuracy of measurement by means of a mental scale in an entirely different field, five rods ranging from 10 inches to 23 inches were judged in terms of inches by eleven experienced carpenters. The mean variation of these estimates is identical with the variation of the grades, which indicates that the deviation of the marks is not due to the nature of the examination paper but it implies that measurements by means of a mental scale simply cannot be made any more accurately.

The steps on a scale should be at least twice the size of the mean variation or probable error of the measurements in order to be distinguishable steps. Hence the steps on a marking scale should be at least two times 4.2 or approximately 8 points. And hence, on a scale of passing grades of 70 to 100 only four steps can be used with any degree of objective reliability.

*Intelligence of 600 Young Children.* WILL S. MONROE, State Normal School, Montclair, New Jersey.

Three hundred boys and the same number of girls between the ages of three and six years were tested in matching and naming the six standard colors. In the color perception test, the girls were 8 per

cent. ahead of the boys at the age of 3; 7 per cent. at the age of 4, and 4 per cent. at the age of 6; but at the age of 5 the boys were 2 per cent. ahead of the girls. In the color name test, the girls led the boys at all ages—3 per cent. at the age of 3, 18 per cent. at the age of 4, 4 per cent. at the age of 5, and 13 per cent. at the age of 6.

The same children were given the Binet intelligence tests for the third, fourth, fifth, and sixth years. In the third year tests, the girls led the boys in four out of the five tests; in the fourth year tests, sex differences were very slight; the boys led the girls in all of the fifth year tests, and in the sixth year, the girls led the boys in five of seven tests.

The results of the tests suggest that they are reasonably well placed with regard to the mental ages of children from 3 to 6 years. In the third year tests, the boys made an average of 90 per cent. and the girls 91 per cent. Boys of 4 years passed the fourth year tests with an average of 96 per cent. and girls 95 per cent. The fifth year tests stood for boys 89 per cent. and for girls 87 per cent. In the sixth year tests, six year old boys made an average of 88 per cent. and girls of the same age 90 per cent. Sex differences were less pronounced in the Binet tests than in the color tests.

*Three Annual Testings of 400 Feeble-Minded Children and 500 Normal Children.* H. H. GODDARD, Vineland Training School, N. J.

The entire population of the Vineland Training School for Mental Defectives has now had three annual testings by the Binet scale. Their mentality as measured by this scale agrees with that which experience has taught us after dealing with them for numbers of years.

Of the 352 last tested, 109 have remained absolutely the same, while 232 or 65.9 per cent. have not varied more than two points in the two years, some losing and some gaining; 22 individuals, that is, 6.25 per cent., have gained more than 5 points, that is, more than one year in two years. These are all the younger cases who perhaps have not yet entirely stopped their mental development and some of them are special cases who have been receiving special treatment, such as pineal gland extract or other treatment; 19 have lost either 3, 4 or 5 points. These are all the older children, averaging in the neighborhood of 27 years of age. These testings were made by different individuals, but always by trained persons. It would seem to be strong evidence for the accuracy of the tests, agreeing as they do at every point with observation and experience with these children.

*Public School Cases.*—As reported previously, 2,000 public school children, an entire school system, were tested two years ago. One year ago, the children in half of these schools were retested, giving us approximately 800 cases. This year, all those who had been previously tested twice were again tested, giving us three testings on a group of 464 children. The study of the result of these retestings shows that 227 or 49 per cent. of the whole made normal or more than normal progress, that is, an average of 5 points per year, while 219 cases or 47.2 per cent. of the whole made approximately one half of normal progress. Six cases or 1.25 per cent. made no progress, while 12 cases or 2.5 per cent. retrograded one or more points. This is again a remarkable testimony of the reliability of the Binet Scale, especially when we consider that these testings were made by different people, some of whom were not highly trained and the personal equation comes in to affect the results here to a large extent. Nevertheless, a careful analysis of the results, much more than can be presented here, shows that the variations are very largely accounted for by the personal equation and that the scale itself in the hands of a trained person is thoroughly reliable.

*A Study of the Personal Equation as Shown in the above Testings.*—Unfortunately there is no considerable number of children that were tested by the same individual on the three successive years, but one person, and that a highly trained one, tested 71 children the second and third year. A similar group were twice tested by other examiners. By a comparison of the results by the trained observers and those of less training, we have been able to show very definitely that some of the examiners have been too easy, and others too severe. The distribution curve of these individual examiners brings this out very clearly.

The same thing is repeatedly shown from the study of the records of individual children. Where, for instance, a child was examined a year ago by a person who is known to have been too easy and given too much encouragement in the tests, such a child, tested this year by a person more highly trained, is found to have made only one or two or perhaps no points of improvement, showing that the person a year ago had marked too high. In short the various combinations of examiners of different personal equations almost invariably agree with the progress or otherwise of the individual children when it is taken into account.

*Conclusion.*—In all cases where a child tests four or more years behind his age, there is little danger of error in considering him



feeble-minded, even though the test was made by a person who was not highly expert, provided such person is able to use the test with reasonable intelligence. With the border-line cases, those who are two or three years backward, the best expert should be employed in the testing.

Other factors, such as progress in school, environment, heredity, or anything that makes the child suspicious or otherwise as to his mentality, should be taken into account. With proper regard to these points, the Binet scale is the most useful means for school-men to understand their children that has ever been devised.

*Eighty-two Children Retested by the Binet Tests of Intelligence.*

CHARLES SCOTT BERRY, University of Michigan.

The subjects were first tested in September and October, 1911, and retested in September and October, 1912. In making the tests the 1911 revision of the Binet scale was used. All the tests were made by the writer and under favorable conditions. Of the eighty-two subjects retested forty-two were school children of Ann Arbor, Michigan, and the rest were defectives from the Michigan Home for Feeble-minded and Epileptic at Lapeer, Michigan.

The school children when retested ranged in physical age from seven to twelve, more than half being either eight or nine. Their total gain as measured by the Binet scale was forty-three years, an average of a year. The average deviation was .26 of a year. The individual gain ranged from .4 of a year to 1.8 years. Sixteen gained less than one year, nine gained exactly one year, and seventeen gained more than one year. In 1911 nineteen tested below age, sixteen at age and seven above age. In 1912 twenty tested below age, thirteen at age, and nine above age. The average gain for those who tested below age in 1911 was .96 of a year, for those at age in 1911 the average gain was 1.02 years, and for those who were above age in 1911 the average gain was 1.17 years.

The forty defectives when retested ranged in physical age from nine to twenty-four, and in mental age from four to eleven years. Their total gain was twenty-one years, an average of a little over .5 of a year. The average deviation was .31 of a year. The individual variation ranged from a loss of .6 of a year to a gain of 1.2 years. Four gained one year or more and three lost ground. The four who gained a year or more were all under fifteen, while the three who lost were all above that age.

These results show: (1) A close correlation with the results of

the original tests. (2) That the average gain of the normal children who tested above age in 1911 was twenty per cent. greater than that of the children who tested below age in 1911. (3) That the average gain for the defectives fifteen and under was fifty per cent. greater than for those above that age, although there were marked individual variations.

*A Report of a Series of Tests Administered to 800 Fourteen-year-old Children.* HELEN T. WOOLLEY and CHARLOTTE RUST FISCHER, Cincinnati.

The investigation of which this series of tests is a part is planned as a study of working children. The 800 children were tested upon leaving school to go to work. About 500 of these same children have been retested after being at work for a year. The tests are also being given to a corresponding series of children who remain in school. Only the first series of tests with working children is included in this report. The report states for each test the norm, the comparison of the sexes, the comparison of types of school, and the correlation with grade. It is impossible to state norms in a brief summary. With regard to sex the following generalizations can be made. In physical development the girls are superior to the boys in height, weight, and perfection of coördination. The boys are superior to the girls in strength, rapidity of motion, and vital capacity. The girls are somewhat superior to the boys in all of the mental tests at this age. Some of these children had completed the fifth grade, some the sixth, some the seventh, and some the eighth. The tests of physical development show a slight, though fairly consistent, correlation with grade. The tests of mental ability show a very marked correlation with grade.

*Psychological Tests Applied to Criminal Women.* JEAN WEIDENSALL, State Reformatory, Bedford Hills, New York.

*Some Results of Association Tests Among Delinquent Girls.* ELMER E. JONES, University of Indiana.

Five series of association tests were given to 210 delinquent girls in the Indiana Girls School for the purpose of determining their educability. Previous tests had revealed the fact that their retardation was not due to defective sense organs, as had been suspected, and it seemed probable that careful tests might show that the deficiency is due to the lack of the proper coördination and association of the sense material. Accordingly, five series of tests were arranged,

each representing a distinct type of association. They are as follows: Controlled association, form board, naming colors, crossing out A's, and rapid naming of words.

These tests were carefully applied to the whole group, with the result that it was possible to make classifications of the subjects which seemed fully as accurate as the results obtained by applying the Binet scale. So satisfactory was this method of determining normals, morons, and feeble-minded, that it was used almost exclusively instead of the Binet scale. It is far more easily applied, because three out of the five tests can be given with equal satisfaction to groups. One can apply such a scale possibly ten times as rapidly as the Binet scale, and it seems with just as good results.

This suggests the use of some such scale in determining such classifications in the public schools. The Binet scale is so slow in application as to practically preclude its use in measuring all children in a large system; for it has been conclusively proven that the regular teacher cannot apply the scale fairly to her own pupils. If the scale is applied it must be done by some one trained for the work, and some one who is a stranger to the pupils tested. At least this is preferable. But if a scale can be developed which can be applied to a whole room or grade at one time, all working under precisely the same conditions and for the same length of time, it seems highly probable that it will meet with immediate success.

*The Process of Learning of Delinquent Adolescent Girls as Shown by a Substitution Test.* BIRD T. BALDWIN, Swarthmore College.

This investigation was pursued at the girls' division of the Pennsylvania Reformatory School and is based on a study of forty-one delinquent white girls and fifty-four delinquent negroes, who have been committed by the courts of the State for various offences, including incorrigibility, immorality, dependency, malicious mischief, manslaughter, lewdness, fornication, vicious conduct and vagrancy. The girls are of average standard in height and weight when compared with the Bowditch norms, but have a high percentage of sense defects, hypertrophied tonsils, bad teeth and venereal diseases.

A substitution test, which consists of a transliteration of a portion of Franklin's Autobiography into a wig-wag code comprising two, three or four short marks to the right or left of vertical lines for respective letters, was given for sixteen days to the subjects in five groups. The conditions for limiting the practice to the desired five-minute periods were unusually good because no paper or pencils are permitted except in certain class exercises.

The curves show a wide range of individual differences. Among the white girls the best accomplished, on the average, 111 substitutions for the sixteen practice periods; the least efficient white girl accomplished, on the average, 26 substitutions. The composite learning curve for the group of forty-one white girls is based on 44, 179 substitutions, and shows distinct periods of acceleration and retrogression with an increase from 23 for the first trial to 109 for the last trial. The average for all white subjects, including all trials, is 71 substitutions.

The subsequent acquisitions in efficiency are, in the main, a distinction between right and left; the location of the symbols in the code; a knowledge of the numerical equivalents of the letters; a change in reading from letters to syllables, words, phrases or clauses; and in the motor reactions of making symbols. The errors consist primarily in the wrong symbols, and in the omission of letters, syllables or words and occasionally in the repetition of a letter.

The negro girls accomplish less work; they are also less accurate, less easily enthused and are more controlled by moods than the white girls. Fourteen of the negroes were too feeble in mind to learn how to carry out the test, but the other forty, with ten exceptions, were the best negroes in the school. The best negro girl completed, on the average, 91 substitutions and the poorest 32. These forty negro girls accomplished in all 33,488 substitutions. The composite learning curve for the group starts with 22 substitutions and ends with an average of 93. The composite average for all individuals and for all trials is 55 substitutions, which shows the negroes in this test accomplish 77.9 per cent. as much work as the white girls, disregarding errors. The negroes make more than twice as many errors as the white girls.

*A Pictorial Completion Test.* WILLIAM HEALY, Chicago Juvenile Psychopathic Institute.

The result of our own prolonged clinical experience with following up work on cases leads us to be very skeptical about a snap-shot diagnosis for any given individual despite sharp correlations with general ability for a certain few tests. More good tests are still needed to aid diagnosis in difficult cases. The Ebbinghaus test is unquestionably of great value, but in our work we found it impossible to adopt this test because of language difficulties, viz., inequalities of training in language and the prevalent use of foreign languages.



A pictorial completion test was devised and gradually evolved to its present shape. It is an open air scene with children's various activities depicted by an experienced illustrator for children. This has been lithographed and mounted on scroll-saw wood. Ten groups or activities are represented and from each group activity is cut a piece one inch square containing an object necessary to the meaning of the group activity. Besides these pieces there are 40 other similarly sized squares which have depicted on them other objects or bits of the indifferent background, which when placed in position either make meaningless combinations or else are only vaguely related to the group. The 50 pieces are placed at the side when the test is offered and they represent, as it were, the store of ideas. One space is deliberately shown to the examinee and it is at once ascertained whether or not the meaning of the test is clear. It is a real completion test analogous in many ways to the Ebbinghaus verbal method, and like his test could be readily varied in simplicity or difficulty and adapted to individuals with varied types of experience. To this end other pictures could, with some trouble, be devised.

We have established norms on the basis of several hundred observations where the test was given in connection with a whole series of observations which enabled us to mentally classify the individual. Above the age of 9 years there seems to be very little difference between the performance of individuals who are to be ranged in the same grade of mental ability. It seems fair to state that one or two final errors may be allowed, but these must always be rationally explicable. Below 9 years and for the group which are below what we have designated as fair or ordinary in ability, the type as well as the number of final errors very rapidly changes. There seems to be little sign of correlation of the ability to do this test with the Binet estimate of a 9 year mental age. We have observed this however on other performance tests and this is one of the points which leads us to believe there will have to be ultimately a greater differentiation of mental defectives according to special abilities.

Our findings on the psychoses with this test have been very interesting and very helpful towards diagnosis on account of the peculiar irregularities and irrationalities which some cases of mental aberrancy have shown. Altogether the idea of this test seems to be of distinct worth for mental diagnosis as offering another means for observing the mind in action, as it were, and avoiding the questionnaire method.

*Qualitative Standardization of Tests of Mental Ability.* CLARA SCHMITT, Chicago Child Study Department.

The results of five of the tests described by Dr. Wm. Healy and Miss Grace Fernald in "Practical Tests for Mental Classification" (PSYCHOL. REV. MON., March, 1911) are here presented. The data were obtained from the application of the tests to 150 normal children.

For the rating of Construction Puzzle B, Test 4, of the above mentioned series the following qualitative standard of performance was adopted: The case was counted as having done the work by the method of trial and error if he made six errors or more in the performance of the test; as having done it by the planned method if he made less than six errors; as having failed if he did not complete the test in 10 minutes. The resulting data are to the effect that more than 50 per cent. of children above the 1st grade do the test in a planned way. The test was then given as a learning test to the children who had failed to do it or had used the trial and error method. In the first case the child was shown how to do it and given as many trials as were necessary to do it without error. One child of the number to whom it was so given required a second learning trial. After the child had learned it the test was given upside down as a test in readjustment. Seventeen did it then with less than 2 errors, 3 with 2 or more errors.

For the Puzzle Box, Test 5, the planned method consisted in doing the test without error after the manipulation of the first step; trial and error method in the making of errors after the manipulation of the first step. More than 50 per cent. of the children in the fifth and sixth grades did the test by the planned method.

Cross Line A, Test 9, was performed at the first trial by 60 per cent. of first grade children, increasing to 100 per cent. with the fifth grade.

Cross Line B, Test 10, was performed at the first trial by 55 per cent. of children in the second grade, increasing to 100 per cent. in the sixth grade.

The Code, Test 11, was given with an additional step involving reasoning ability. Over 50 per cent. of the children from the fourth grade and on were able to accomplish the reasoning step.

*Norms of Mental Efficiency.* W. H. PYLE, University of Missouri.

The purpose of this study was to determine the most helpful and significant mental tests for use in ascertaining the mental capacity

or development of school children and to establish norms of performance in these tests for children from the ages of eight or nine up to maturity. In determining the value of a mental test, its correlation with other tests and with school standing was used as a criterion. After trying most of the standard mental tests that are at all practicable for use with school children in groups, I decided to use the following: (1) The learning or substitution test, which consists in learning to substitute arbitrary characters for the ordinary digits. (2) Logical Memory test, using *The Marble Statue* as prescribed in Whipple's *Manual*. (3) Rote memory, using a list of abstract words and another list of concrete words, prepared by the writer. (4) The cancellation test, using the "A" test as prepared by Stoelting. The Invention test, which consists in making as many words as possible in a certain time using certain prescribed letters. (6) The Ink-blot test, using the standard blots furnished by Stoelting. This is more valuable as a qualitative test than as a quantitative one. (7) Association tests, using the uncontrolled association test (3 minutes), the genus-species test, the part-wholes test and the opposites test.

It is not practicable in a brief abstract to give the table of norms, but they are to be published shortly. The tests have been given to several thousand children. It is the writer's belief that they constitute a reliable series of tests, easily administered by teachers and principals, easily and accurately graded, and that they give a very reliable indication of the pupil's ability. These tests should be given to all school children in the third grade and above, and the records carefully kept so that the growth of the child can be followed through the grades.

*Psychophysiological Tests During a Prolonged Fast.* H. S. LANGFELD, Harvard University.

Agostino Levanzin, age 40, a lawyer of Malta, underwent a 31-day fast at the Carnegie Nutrition Laboratory of Boston. The only form of nutrition was 750 c.c. of water daily.

His weight before was 60.6 kg.; after, 47.4 kg. There was a gross drop in metabolism of about 25 per cent., and a drop per pound of about 15 per cent.

The tests were made daily, including two days before and one after the fast, at 5 P.M. There are rather large fluctuations from day to day in most of the curves. Order of procedure and results based on general tendencies of curves are as follows:

1. Rote memory for words (10 words, auditory): Slight improvement.

2. Tapping (30 seconds): Fall midway with recovery to initial level. Fatigue midway. Initial spurt on last few days.
3. Strength test (dynamometer. 10 trials for each hand. Subject left-handed): Slight fall in right hand, considerable fall in left. More frequent initial spurts with right, especially during first twenty days, than with left, and less fatigue.
4. Tactual space threshold (esthesiometer, under side of left forearm. Method of minimal change): Very slight improvement. Av. cir. 6 cm.
5. Immediate memory for digits: No change.
6. Association reaction (20 words, 5 from each of 4 categories): Decrease in reaction time. Av. time cir. 1.6 seconds.
7. Repetition of same 20 words: Errors throughout negligible. Slight decrease in reaction time. Av. cir. 1.1 seconds.
8. A Test (100 A's, 50 each of other letters. Different arrangement daily): Decrease in time. Accuracy high throughout.
9. Visual Acuity: Decided improvement.
10. Memory for 10 words after 55 seconds: Improvement.

*General Conclusion.*—The prolonged fast brought about improvement in those higher centers involved in discrimination, memory and association. The effect of practice must be considered. There was a loss in muscular reaction.



